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SERIES OF RATIONAL TRIANGLES.

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The following is the simplest method known to the writer of finding the dimensions of prime, integral, rational, scalene triangles in series.

PROBLEM: There is an infinite series of rational, scalene triangles in which there is a difference of 1 between the two short sides of every term, and the longest side is one less than double the shortest.

SOLUTION: Let x , $x+1$, and $2x-1$ represent the sides.

Then $2x \cdot x(x-1) = \square$: $2(x-1) = \square$: $2x-2 = \square$.

$$x = \frac{\square}{2} + 1 = 3 \ 9 \ 19 \ 33 \ 51 \ 73 \ 99 \ 129 \ 163 \ 201 \ 243 \ 289 \ 339 \ 393 \ 451 \ \&c.$$

$$x+1 = 4 \ 10 \ 20 \ 34 \ 52 \ 74 \ 100 \ 130 \ 164 \ 202 \ 244 \ 290 \ 340 \ 394 \ 452 \ \&c.$$

$$2x-1 = 5 \ 17 \ 37 \ 65 \ 101 \ 145 \ 197 \ 257 \ 325 \ 401 \ 485 \ 577 \ 677 \ 785 \ 901 \ \&c.$$

General expressions: $2n^2 + 1$, $2(n^2 + 1)$, $(2n)^2 + 1$.

PROBLEM: In a certain series of rational Δ 's there is a constant difference of 2 between two sides, and the third one is 2 less than twice the shortest.

SOLUTION: Let x , $x+2$, $2x-2$, represent sides of Δ : $2x \cdot x \cdot 2(x-2) = \square$.

$$x = \square + 2 = 3 \ 11 \ 27 \ 51 \ 83 \ 123 \ 171 \ 227 \ 291 \ 363 \ 443 \ 531 \ 627 \ 731 \ \&c.$$

$$x+2 = 5 \ 13 \ 29 \ 53 \ 85 \ 125 \ 173 \ 229 \ 293 \ 365 \ 445 \ 533 \ 629 \ 733 \ \&c.$$

$$2x-2 = 4 \ 20 \ 52 \ 100 \ 164 \ 244 \ 340 \ 452 \ 580 \ 724 \ 884 \ 1060 \ 1252 \ 1460 \ \&c.$$

General expressions: $(2n-1)^2 + 2$, $(2n-1)^2 + 4$, and $2(2n-1)^2 + 2$.

PROBLEM: In an infinite series of rational, scalene Δ 's, there is a difference of 8 in two of the sides, and the other one is 8 less than twice the shortest.

SOLUTION: Represent the sides by x , $x+8$, and $2x-8$.

Then $2x \cdot x \cdot 8(x-8) = \square$.

$$x = \square + 8 = 9 \ 17 \ 33 \ 57 \ 89 \ 129 \ 177 \ 233 \ 297 \ 369 \ 449 \ 537 \ 633 \ 737 \ \&c.$$

$$x+8 = 17 \ 25 \ 41 \ 65 \ 97 \ 137 \ 185 \ 241 \ 305 \ 377 \ 457 \ 545 \ 641 \ 745 \ \&c.$$

$$2x-8 = 10 \ 26 \ 58 \ 106 \ 170 \ 250 \ 346 \ 458 \ 586 \ 730 \ 890 \ 1066 \ 1258 \ 1466 \ \&c.$$

General expressions $(2n-1)^2 + 2 \cdot 2^2$, $(2n-1)^2 + 4^2$, $2 \{ (2n-1)^2 + 2^2 \}$

PROBLEM: In an infinite series of rational, scalene Δ 's, there is a difference of 9 in two of the sides, and the other one is 9 less than twice the shortest.

SOLUTION: $2x \cdot x \cdot 9(x-9) = \square$: $2(x-9) = \square$: $x-9 = \frac{\square}{2}$.

$$x = \frac{\square}{2} + 9 = 11 \ 17 \ . \ 41 \ 59 \ . \ 107 \ 137 \ . \ 209 \ 251 \ . \ 347 \ 401 \ 521 \ 587 \ \&c.$$

$$x+9 = 20 \ 26 \ . \ 50 \ 68 \ . \ 116 \ 146 \ . \ 218 \ 260 \ . \ 356 \ 410 \ 530 \ 596 \ \&c.$$

$$2x-9 = 13 \ 25 \ . \ 73 \ 109 \ . \ 205 \ 265 \ . \ 409 \ 475 \ . \ 685 \ 793 \ 1033 \ 1165 \ \&c.$$

PROBLEM: In an infinite series of rational, scalene Δ 's, there is a difference of 18 in two of the sides, and the other one is 18 less than twice the shortest.

SOLUTION: $2x(x-18) 18x = \square : x = \square + 18.$

$$x = \square + 18 = 19\ 43\ 67\ 139\ 187\ 307\ 379\ 547\ 643\ 859\ 979\ 1243 \text{ &c.}$$

$$x + 18 = 37\ 61\ 85\ 157\ 205\ 325\ 397\ 565\ 661\ 877\ 997\ 1261\ " "$$

$$2x - 18 = 20\ 68\ 116\ 260\ 356\ 596\ 740\ 1076\ 1268\ 1700\ 1940\ 2468\ "$$

PROBLEM: In an infinite series of rational, scalene Δ 's there is a difference of 25 in two of the sides, and the other one is 25 less than twice the shortest.

SOLUTION: $2x.x.25(x-25) = \square : 2(x-25) = \square.$

$$x = \frac{\square}{2} + 25 = 27\ 33\ 43\ 57\ 97\ 123\ 153\ 187\ 267\ 363\ 417 \text{ &c.}$$

$$x + 25 = 52\ 58\ 68\ 82\ 122\ 148\ 178\ 212\ 292\ 388\ 442\ "$$

$$2x - 25 = 29\ 41\ 61\ 89\ 169\ 221\ 281\ 349\ 509\ 701\ 809\ "$$

PROBLEM: In an infinite series of rational, scalene Δ 's, there is a difference of 32 in two of the sides, and the other one is 32 less than twice the shortest.

SOLUTION: $2x.x.32(x-32) = \square : x - 32 = \square.$

$$x = \square + 32 = 33\ 41\ 57\ 81\ 113\ 153\ 201\ 257\ 321\ 393 \text{ &c.}$$

$$x + 32 = 65\ 73\ 89\ 113\ 145\ 185\ 233\ 289\ 353\ 425\ "$$

$$2x - 32 = 34\ 50\ 82\ 130\ 194\ 274\ 370\ 482\ 610\ 754\ "$$

PROBLEM: In an infinite series of rational, scalene Δ 's, there is a difference of 49 in two of the sides, and the other one is 49 less than twice the shortest.

SOLUTION: $2x.x.49(x-49) = \square : 2(x-49) = \square.$

$$x = \frac{\square}{2} + 49 = 51\ 57\ 67\ 81\ 99\ 121\ 177\ 211\ 249 \text{ &c.}$$

$$x + 49 = 100\ 106\ 116\ 130\ 148\ 170\ 226\ 260\ 298\ "$$

$$2x - 49 = 53\ 65\ 85\ 113\ 149\ 193\ 305\ 373\ 449\ "$$

PROBLEM: In an infinite series of rational, scalene Δ 's, there is a difference of 50 in two of the sides, and the other one is 50 less than twice the shortest.

SOLUTION: $2x.x.50(x-50) = \square : x - 50 = \square.$

$$x = \square + 50 = 51\ 59\ 99\ 131\ 171\ 219\ 339\ 411\ 491\ 579 \text{ &c.}$$

$$x + 50 = 101\ 109\ 148\ 181\ 221\ 269\ 389\ 461\ 541\ 629\ "$$

$$2x - 50 = 52\ 68\ 149\ 212\ 292\ 388\ 628\ 772\ 932\ 1108\ "$$

PROBLEM: In a certain series of rational Δ 's there is a constant difference of 72 between two sides, and the third one is 72 less than twice the shortest.

SOLUTION: $2x.x.72(x-72) = \square : x - 72 = \square.$

$$x = \square + 72 = 73\ 97\ 121\ 193\ 241\ 361\ 433\ 601\ 697\ 913 \text{ &c.}$$

$$x + 72 = 145\ 169\ 193\ 265\ 313\ 433\ 505\ 673\ 769\ 985\ "$$

$$2x - 72 = 74\ 122\ 170\ 314\ 410\ 650\ 794\ 1130\ 1322\ 1754\ "$$

